

Incidence of Hidradenitis Suppurativa and Associated Factors: A Population-Based Study of Olmsted County, Minnesota

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There are no population-based incidence studies of hidradenitis suppurativa (HS). Using the medical record linkage system of the Rochester Epidemiology Project, we sought to determine the incidence of the disease, as well as other associations and characteristics, among HS patients diagnosed in Olmsted County, Minnesota, between 1968 and 2008. Incidence was estimated using the decennial census data for the county. Logistic regression models were fit to evaluate associations between patient characteristics and disease severity. A total of 268 incident cases were identified, with an overall annual age- and sex-adjusted incidence of 6.0 per 100,000. Age-adjusted incidence was significantly higher in women compared with men (8.2 (95% confidence interval (CI), 7.0–9.3) vs. 3.8 (95% CI, 3.0–4.7)). The highest incidence was among young women aged 20–29 years (18.4 per 100,000). The incidence has risen over the past four decades, particularly among women. Women were more likely to have axillary and upper anterior torso involvement, whereas men were more likely to have perineal or perianal disease. In addition, 54.9% (140/255) patients were obese; 70.2% were current or former smokers; 42.9% carried a diagnosis of depression; 36.2% carried a diagnosis of acne; and 6% had pilonidal disease. Smoking and gender were significantly associated with more severe disease.

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INTRODUCTION

Hidradenitis suppurativa (HS) is a chronic, recurrent, inflammatory disorder of hair follicles in apocrine gland-bearing sites, resulting in abscesses and potentially fistula formation (Alikhan *et al.*, 2009). Associations with smoking, obesity, and inflammatory bowel disease have been described (Revuz *et al.*, 2008; Sartorius *et al.*, 2009; van der Zee *et al.*, 2010). HS can be debilitating and devastating, significantly compromising the quality of life (Wolkenstein *et al.*, 2007; Matusiak *et al.*, 2010a; Esmann and Jemec, 2011). Furthermore, it represents a diagnostic and treatment challenge not only to dermatologists but also to primary care physicians and surgeons (Alikhan *et al.*, 2009).

Despite the severity of the disorder, little epidemiological data have been published (Alikhan *et al.*, 2009). Depending on the study, prevalence rates have ranged from 0.00033 to 4% (Fitzsimmons *et al.*, 1985; Jemec, 1988; Lookingbill,

1988; Jemec *et al.*, 1996; Revuz *et al.*, 2008). To our knowledge, there are no population-based data on incidence. The primary purpose of this study was to calculate the incidence of HS using population-based data from a single well-studied and well-characterized US county. Data relating to demographic variables, diagnostic criteria, treatment and outcomes, and associations with other medical disorders are also presented.

RESULTS

Between 1968 and 2008, 1,263 patients who had received a diagnosis of HS were identified using the Rochester Epidemiology Project (REP) resources. Of these, 268 were confirmed to have a first-ever diagnosis of HS as a resident of Olmsted County using the criteria outlined below.

The characteristics of the 268 patients confirmed to have HS are summarized in Table 1. The median age at the time of diagnosis was 30.6 years (range 9.9–78.5 years). The median time between onset of symptoms and diagnosis was 3.3 years (range 0–30 years). The majority of patients were white (90.3%), reflecting the general demographics of Olmsted County. The median body mass index (BMI) was 31.1 kg m⁻², and 54.9% (140/255) had a BMI of 30 kg m⁻² or greater. At the time of their diagnosis, 57.7% of cases reported currently smoking and an additional 12.5% had smoked before their diagnosis.

Incidence data are summarized in Tables 2 and 3. The overall annual age- and sex-adjusted incidence of HS in

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Abbreviations: BMI, body mass index; CI, confidence interval; HS, hidradenitis suppurativa; REP, Rochester Epidemiology Project

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Table 1. Demographic and diagnostic characteristics of hs patients

Characteristic	Total (N=268)
Gender	
Female	189 (70.5%)
Male	79 (29.5%)
Age at diagnosis (years)	
Mean (SD)	32.9 (12.6)
Median	30.6
Range	(9.9–78.5)
Race	
White	241 (90.3%)
Non-white	26 (9.7%)
Unknown	1
Education level (years)	
> 12	139 (57.9%)
12	57 (23.8%)
< 12	44 (18.3%)
Unknown	28
BMI (kg m^{-2})	
N	249
Mean (SD)	32.6 (8.7)
Median	31.1
Range	(18.3–66.7)
BMI breakdown	
Underweight or normal (<25)	49 (19.2%)
Overweight (25.0–29.9)	66 (25.9%)
WHO class I obesity (30.0–34.9)	49 (19.2%)
WHO class II obesity (35.0–39.9)	49 (19.2%)
WHO class III obesity (40.0–49.9)	33 (12.9%)
Super obese (50+)	9 (3.5%)
Unknown ¹	13
Smoking status	
Never	79 (29.8%)
Current	153 (57.7%)
Former	33 (12.5%)
Unknown	3
1st or 2nd degree family members affected?	
Yes	22 (8.2%)
No	117 (43.7%)
Unknown	129 (48.1%)

Table 1. Continued

Characteristic	Total (N=268)
Time between symptom onset and diagnosis (years)	
N	156
Mean (SD)	5.1 (5.8)
Median	3.3
Range	(0.0–30.0)
Diagnosis of HS rendered by	
Dermatologist	171 (63.8%)
Non-dermatologist but meets 4 criteria listed	97 (36.2%)

Abbreviations: BMI, body mass index; HS, hidradenitis suppurativa; WHO, World Health Organization.

¹Of the 19 patients missing BMI, 6 patients had a description of body habitus by the physician that was recorded and abstracted.

Olmsted County during 1968–2008 was 6.0 per 100,000 person-years (95% confidence interval (CI), 5.2–6.7). The incidence was significantly higher among women than among men, 8.2 per 100,000 (95% CI, 7.0–9.3) and 3.8 per 100,000 (95% CI, 3.0–4.7), respectively ($P<0.001$). The highest incidence was among women aged 20–29 years (18.4 per 100,000). This was also the age range with the highest incidence for men (7.4 per 100,000). There was a sharp decline in incidence among women after the age of 49 years. There was also a decline among men, but the rate of decline across the age groups after the age of 20 years was significantly different between the sexes ($P=0.014$). Incidence of HS by calendar decade demonstrates a steady increase from 4.3 per 100,000 (95% CI, 2.8–5.8) during 1970–1979 to 9.6 per 100,000 (95% CI, 7.8–11.3) during 2000–2008. This increasing trend across the decades was more apparent in women ($P<0.001$) than in men ($P=0.20$).

At the time of diagnosis, 160 (59.7%) patients had Hurley stage I disease, 102 (38.1%) had Hurley stage II disease, and 6 (2.2%) had Hurley stage III disease. Disease involvement by site and gender is summarized in Table 4. Axillary involvement was present in 165 (61.6%) patients, and was significantly more common in women than in men (67.7% vs. 46.8%, $P=0.001$), as were upper torso involvement (24.9% vs. 2.5%, $P<0.001$) and groin or thigh involvement (73.0% vs. 60.8%, $P=0.047$). Conversely, men were significantly more likely to have perianal or perineal disease (20.3% vs. 5.8%, $P<0.001$).

A diagnosis of depression was found in 115 (42.9%) patients. A history of acne was present in 97 (36.2%) of the patients. On the basis of clinical description, 28 (28.9%) had mild acne, 39 (40.2%) had moderate acne, and 24 (24.7%) had severe acne. Pilonidal disease was present in 16 (6%) patients, but none carried a diagnosis of acne conglobata or dissecting cellulitis of the scalp. Aside from acne and pilonidal disease, no other concurrent dermatological disorder or malignancy occurred frequently enough to warrant analysis. The same is true of internal malignancies.

Patient characteristics were evaluated for an association with disease severity, defined as Hurley grade I vs. II or III (Table 5). In univariate analysis, age, male sex, and any history of smoking demonstrated a statistically significant association with greater disease severity. However, after adjusting for age, only male sex remained significantly associated with disease severity ($P=0.015$). There were no significant associations identified between disease severity and BMI, depression, acne, or pilonidal disease.

DISCUSSION

Our population-based study of HS demonstrates an overall annual incidence of 6.0 per 100,000 person-years during 1968–2008. The highest incidence is among young women aged 20–29 years (18.4 per 100,000). The incidence is significantly higher among women than among men, and the incidence among women has trended upward over the past four decades. The incidence is highest between the ages of 20

and 49 years, with a particularly steep decline among women, after the age of 49 years. Male patients and patients with a smoking history were more likely to have a higher disease severity. In terms of site involvement, women were more likely to have axillary and upper anterior torso involvement, whereas men were more likely to have perineal or perianal disease. The majority of patients were overweight or obese, and many carried a diagnosis of depression.

Prevalence of HS has varied from as low as 1 in 3,000 to as high as 4% (Lookingbill, 1988; Jemec *et al.*, 1996). Two fairly recent studies have estimated the prevalence to be about 1% (Jemec *et al.*, 1996; Revuz *et al.*, 2008), and as high as 4% among young adults at a Danish sexually transmitted disease clinic (Jemec *et al.*, 1996). Thus, it has been suggested that HS may be a common disease. However, these studies may have been influenced by referral bias and issues with patient self-reporting. In contrast, our data suggest that HS is a rare disease. Interestingly, the majority of cases we reviewed did not meet the diagnostic criteria proposed by Alikhan *et al.* (2009).

It is noteworthy that the incidence of HS appears to be increasing steadily over the past four decades. This trend was noted particularly among women. Although it is beyond the

Table 2. Incidence of hidradenitis suppurativa per 100,000 persons by age and gender in Olmsted county, Minnesota, 1968–2008

Age group, years	Women		Men		Both sexes	
	No. of cases	Rate per 100,000	No. of cases	Rate per 100,000	No. of cases	Rate per 100,000
0–19	30	4.4	7	1.0	37	2.7
20–29	66	18.4	23	7.4	89	13.3
30–39	50	14.2	23	6.7	73	10.5
40–49	36	12.3	14	5.0	50	8.7
50–59	3	1.5	5	2.6	8	2.0
60+	4	1.2	7	2.9	11	1.9
Total (95% CI)		8.2 (7.0–9.3) ¹		3.8 (3.0–4.7) ¹		6.0 (5.2–6.7) ²

Abbreviation: CI, confidence interval.

¹Incidence per 100,000 person-years is directly age-adjusted to the population structure of the US total population in 2000.

²Incidence per 100,000 person-years is directly age- and sex-adjusted to the population structure of the US total population in 2000.

Table 4. Site of disease by gender

Location	Female (N=189)	Male (N=79)	P-value ¹
Abdomen	5 (2.7%)	5 (6.3%)	0.15
Chest, breast, or inframammary	47 (24.9%)	2 (2.5%)	<0.001
Axilla	128 (67.7%)	37 (46.8%)	0.001
Perineal or perianal	11 (5.8%)	16 (20.3%)	<0.001
Scrotum	NA	5 (6.3%)	NA
Groin or thigh	138 (73.0%)	48 (60.8%)	0.047
Buttock or gluteal cleft	27 (14.3%)	10 (12.7%)	0.72
Neck or ear	3 (1.6%)	3 (3.8%)	0.27

Abbreviation: NA, not applicable.

¹Two-sided chi-square test.

Table 3. Incidence of hidradenitis suppurativa per 100,000 persons by 10-year intervals in Olmsted County, Minnesota, 1970–2008

Period ¹	Women		Men		Both sexes	
	No. of cases	Incidence rate per 100,000 (95% CI) ²	No. of cases	Incidence rate per 100,000 (95% CI) ²	No. of cases	Incidence rate per 100,000 (95% CI) ³
1970–1979	22	5.4 (3.0–7.7)	13	3.2 (1.4–5.0)	35	4.3 (2.8–5.8)
1980–1989	28	5.3 (3.3–7.4)	18	4.0 (2.1–5.8)	46	4.6 (3.2–6.0)
1990–1999	52	8.7 (6.3–11.0)	16	2.8 (1.4–4.2)	68	5.7 (4.4–7.1)
2000–2008	85	14.1 (11.1–17.1)	30	5.2 (3.3–7.1)	115	9.6 (7.8–11.3)

Abbreviation: CI, confidence interval.

¹Four cases (two women and two men) were omitted from 1968–1969.

²Incidence per 100,000 person-years is directly age-adjusted to the population structure of the US total population in 2000.

³Incidence per 100,000 person-years is directly age- and sex-adjusted to the population structure of the US total population in 2000.

Table 5. Univariate and multivariate analysis of gender, smoking, BMI, acne, and depression as it relates to HS severity

Characteristic	Hurley grade II or III, no. (%)	OR (95% CI)	P-value from univariate logistic regression analysis
Age at diagnosis (years) ¹			0.021
≤23.4 (N=67)	20 (29.9%)	Referent	
23.5–30.6 (N=68)	34 (50.0%)	2.4 (1.2–4.8)	
30.7–40.3 (N=66)	21 (31.8%)	1.1 (0.5–2.3)	
≥40.5 (N=67)	33 (49.3%)	2.3 (1.1–4.6)	
Gender			0.006
Male (N=79)	42 (53.2%)	2.1 (1.2–3.6)	
Female (N=189)	66 (34.9%)	Referent	
Smoking history			0.016
Past/current (N=186)	84 (45.2%)	2.0 (1.1–3.5)	
Never (N=79)	23 (29.1%)	Referent	
Unknown (N=3)			
BMI			0.63
≥30 kg m ⁻² (N=140)	59 (42.1%)	1.1 (0.7–1.9)	
<30 kg m ⁻² (N=115)	453 (39.1%)	Referent	
Unknown (N=13)			
Acne diagnosis ever			0.35
Yes (N=97)	43 (44.3%)	1.3 (0.8–2.1)	
No (N=169)	65 (38.5%)	Referent	
Unknown (N=2)			
Depression diagnosis ever			0.74
Yes (N=115)	45 (39.1%)	0.9 (0.6–1.5)	
No (N=153)	63 (41.2%)	Referent	
Pilonidal disease			0.77
Yes (N=16)	7 (43.8%)	1.2 (0.4–3.2)	
No (N=252)	101 (40.1%)	Referent	

Abbreviations: BMI, body mass index; CI, confidence interval; OR, odds ratio.

¹Age was categorized based on the quartiles of the age distribution.

scope of this study to identify the underlying etiology for this trend, it is likely multifactorial. Obesity, smoking, and physicians' awareness and capacity to diagnose this disease may all have a role.

Peak incidence of HS occurred in the third decade, with sharp decline after the fifth decade. Revuz *et al.* (2008) demonstrated a similar decrease of HS prevalence among

people aged 55 years and older. This trend is likely due to the onset of menopause among women, where the sharpest decline was noted. The onset of HS among women after menopause has previously been reported as rare (Thornton and Abcarian, 1978; Fitzsimmons *et al.*, 1985), a claim supported by our data.

Our data demonstrate several important differences in disease characteristics between men and women. Axillary, upper anterior torso, and groin involvement were more common among women, whereas perianal and perineal involvement were more common among men. Similar patterns have been noted in previously studied HS patient populations (Anderson and Dockerty, 1958; Jemec, 1988; Jemec *et al.*, 1996; Canoui-Poittrine *et al.*, 2009). In addition, men were more likely than women to have Hurley stage II or III disease. Increased disease severity among male HS patients has been demonstrated previously by Canoui-Poittrine *et al.* (2009) using the Sartorius scoring system.

Nearly 70% of patients in our study were current or former smokers, which is similar to or lower than the data published by König *et al.* (1999), Revuz *et al.* (2008), Canoui-Poittrine *et al.* (2009), and Sartorius *et al.* (2009). It is well accepted that smoking may be a triggering or exacerbating factor in HS. In addition, we found smoking to be associated with worse disease (higher Hurley stage), which was also demonstrated by Sartorius *et al.* (2009), but not by Canoui-Poittrine *et al.* (2009). There is even some evidence that smoking cessation may improve HS (Simonart, 2010).

On average, patients in our study were obese (mean BMI=32.6). This is consistent with, although somewhat higher than, the data reported by Sartorius *et al.* (2009) (mean BMI=28.3, overweight) and much higher than the data reported by Canoui-Poittrine *et al.* (2009) (mean BMI=25.6, overweight) and Revuz *et al.* (2008) (mean BMI=25.6, overweight). We did not find a correlation between BMI and more severe disease, although this has been demonstrated previously by Canoui-Poittrine *et al.* (2009).

Although HS is commonly grouped in a follicular occlusion tetrad with pilonidal disease, acne conglobata, and dissecting cellulitis, we only appreciated an association with pilonidal disease (6% of patients). This association is somewhat weaker than that demonstrated by Canoui-Poittrine *et al.* (2009), in which 90 of 302 (30.2%) HS patients had concomitant pilonidal disease. Nearly 40% of patients carried a current or prior diagnosis of acne vulgaris. It is difficult to comment on the accuracy of these data, as oftentimes patients do not seek medical care for acne, and thus acne is not mentioned in notes or coded for billing purposes. In any case, we did not find a correlation between acne severity and HS severity, and a diagnosis of acne was seen in a similar percentage of male and female patients (35.9% and 36.7%, respectively).

Over 40% of HS patients in our study carried a diagnosis of depression, compared with a lifetime prevalence of mood disorders in the general population of 20.8% (Kessler *et al.*, 2005). This is not surprising, as several studies have demonstrated a decreased quality of life in patients with HS (Wolkenstein *et al.*, 2007; Matusiak *et al.*, 2010a,b). In fact,

patients with HS may have a lower quality of life than patients with neurofibromatosis 1, chronic urticaria, psoriasis, acne vulgaris, Darier disease, Hailey-Hailey disease, and atopic dermatitis (Wolkenstein *et al.*, 2007; Matusiak *et al.*, 2010a). Quality of life in HS has also been shown to correlate with disease severity, duration, pain, continuous evolution, particular locations (e.g., perianal), uncovered locations, and more involved locations (Wolkenstein *et al.*, 2007; Matusiak *et al.*, 2010a, b).

Our data have several important limitations. The population studied was primarily Caucasian and limited to Southeast Minnesota. Thus, data collected in our study may not be representative of HS patients in other countries or even in different parts of the US. Furthermore, strict diagnostic criteria (described below) were used, which determined inclusion into our study—it is possible that true cases of HS were excluded. As one of the criteria was “symptomatology for at least 6 months,” it is possible that early mild cases were missed. Nevertheless, the overwhelming majority of excluded cases were clearly not HS, but rather ruptured epidermoid cysts, furuncles, folliculitis, or contact or irritant dermatitis; we also noted that many cases were called HS simply because symptoms occurred in common anatomic locations for HS (e.g., axilla or groin). It is unlikely that many true cases of HS were missed owing to our strict diagnostic criteria.

Although our study has several limitations, it is, to our knowledge, a previously unreported population-based incidence study on HS. We have demonstrated that HS is a rare disease, although its incidence appears to be rising with time. It is associated with a current or previous smoking history, obesity, and gender. Furthermore, there is an association between severity of HS and gender, as well as severity of HS and smoking. There are also important differences in sites of involvement between men and women. HS patients appear to have high rates of depression. Further studies should be prospectively conducted to more accurately assess the clinical outcomes and optimal treatments of patients with HS.

MATERIALS AND METHODS

Study setting

We reviewed cases of HS within the population of Olmsted County, Minnesota. Olmsted County is located in the southeastern corner of Minnesota, roughly 90 miles southeast of Minneapolis and St Paul. According to the 2010 US Census, Olmsted County had a population of 144,000 people with over 70% of the population residing within Rochester. The US Census data indicate that residents are largely white—not of Hispanic origin (83% in 2010)—and the level of college graduates is relatively higher than the general population of Minnesota (39% report having a bachelor’s degree or higher in Olmsted county compared with 31% for the entire state). Despite these educational differences, prior comparisons have shown this population to be socioeconomically and demographically similar to the general US white population (Melton, 1996; Maradit Kremers *et al.*, 2004).

This study was approved by the Mayo Clinic and Olmsted Medical Center institutional review boards. Inpatient and outpatient medical records were obtained for review using the REP. REP is a unique Olmsted County centralized, computerized medical records linkage system containing medical diagnoses and surgical

procedures for nearly all patients in Olmsted County since the 1960s (Melton, 1996). This resource has been successful for various reasons, including the following: (1) the county is isolated from other urban centers, with virtually all medical care in the county concentrated among a small number of providers (e.g., Mayo Clinic, Olmsted Medical Group, Olmsted Community Hospital, regional hospitals, private practitioners, and nursing homes); (2) the out-migration rates are low, and there has been a net in-migration to the county; (3) nearly all providers in the county use a unit medical record system in which all medical information on each patient is accumulated within a single dossier; and (4) detailed indices that contain all clinical and pathologic diagnoses and surgical procedures that have been recorded since 1966 have been carefully organized for research purposes (Maradit Kremers *et al.*, 2004). The overall result is that all medical data (including death certificates) collected on an individual by health-care providers at all levels of medical care are located in a single file (Maradit Kremers *et al.*, 2004).

Study criteria

Through the REP, all medical records for patients receiving a first-ever diagnosis of HS from 1 January 1968 to 31 December 2008 were identified and retrieved using various HICDA (Hospital Adaptation of the International Classification of Diseases) codes (“hydradenitis, NOS,” “hidradenitis, suppurative,” “hydradenitis, suppurative,” “hidradenitis, NOS,” “hydradenitis, NOS,” and “infection, sweat gland”), Berkson codes (“hydrosadenitis,” “inflammation, sweat gland,” “hydradenitis, hydro-adenitis, hidrosadenitis,” and “hidradenitis, hidro-adenitis, hidrosadenitis”), and the International Classification of Disease-9 code “hidradenitis.” Patients who did not provide authorization for research purposes were excluded. Each chart was reviewed to confirm a diagnosis of HS. This was done using the criteria and algorithm outlined by Alikhan *et al.* (2009). Patients with multiple, recurrent, chronic, and bilateral lesions primarily along the milk line, but also in atypical locations (e.g., perineal and perianal region), were considered to have a clinical diagnosis of HS (Table 6). For our purposes, we considered chronic disease to be greater than 6 months duration (from the onset of symptoms). The date of diagnosis used for our study was the date the patient received a first-ever diagnosis of HS by either a dermatologist or a non-dermatologist physician, provided that they met the clinical criteria outlined above. Any chart in which the diagnosis was unclear was reviewed by both abstractors (BGV and AA) to determine whether the clinical findings and history met the outlined criteria. Patients not meeting these criteria, and those for whom a consensus could not be made, were excluded. The study was limited to incident cases; therefore, patients with a diagnosis of HS before residing in Olmsted County were also excluded.

Data collection

The medical records were reviewed by one of two abstractors and the following information was abstracted. Socio-demographic data include age at diagnosis, gender, race, and education level. In addition, smoking status and family history of HS were collected. BMI was calculated using any weight recorded within 6 months of the diagnosis date; otherwise, the description of body habitus by the physician was recorded if available. Comorbid diagnoses were recorded, including depression, anxiety, history of internal malignancy, history of cutaneous malignancy, history of acne, and other

Table 6. Diagnostic criteria for hidradenitis suppurativa and Hurley staging system

*Hidradenitis suppurativa diagnostic criteria*¹

- (1) Is there more than a single inflamed lesion?
- (2) Is the course chronic with new and recurrent lesions?
- (3) Are the lesions bilateral?
- (4) Are the lesions located primarily in the milk line?

Hurley staging

- (I) Abscess formation (single or multiple) without sinus tracts and cicatrization.
- (II) One or more widely separated recurrent abscesses with tract formation and scars.
- (III) Multiple interconnected tracts and abscesses throughout an entire area.

¹Patients had to meet all four criteria for study inclusion, except in cases of atypical locations (e.g., perianal or perineal, buttock or gluteal cleft, neck or ear, scrotum) in which lesions are not primarily located in the milk line.

concurrent dermatological disorders. These were recorded as ever having a diagnosis of these conditions. Patients with a history of acne were graded as mild, moderate, or severe based on the clinical description at the time of diagnosis (CDER, 2005). Anatomic zones affected by HS were recorded, along with disease severity using the Hurley staging system (Table 6) (Alikhan *et al.*, 2009). The abstracted data were entered into a database created for this particular study using REDCap (Research Electronic Data Capture) tools hosted at the Mayo Clinic (Harris *et al.*, 2009). REDCap is a secure, web-based application designed to support data capture for research studies.

Statistical analyses

The data were analyzed using the SAS version 9.2. software package (SAS Institute, Cary, NC). Age- and sex-specific incidence rates in Olmsted County during 1968–2008 were calculated overall and by calendar decade. The incidence rates were calculated with the assumption that the entire population of Olmsted County was at risk. The numerator was the number of persons with HS diagnosis within this period and the denominator was obtained from the decennial census data for 1968–2008, with linear interpolation between census years. Rates were age and sex adjusted to the total population structure of the US in 2000. The 95% CIs for the rates were calculated assuming a Poisson error distribution.

The relation of incidence rates to sex, age, and time period of diagnosis (1970–1979, 1980–1989, 1990–1999, 2000–2008) were assessed by fitting generalized linear models assuming a Poisson error structure using the SAS procedure GENMOD. The observations used for the regression analysis were the crude incidence counts for all combinations of sex, 10-year age groupings, and 10-year time periods, which were offset by the natural logarithm of the number of persons. In the modeling, we first fit sex and age group, testing for an interaction between them, and then the interaction between sex and time period. The significance values of linear trends across age groupings and time periods were each assessed with likelihood ratio statistics with 1 degree of freedom. Overdispersion was accounted

for by estimating a dispersion parameter (i.e., deviance divided by its degrees of freedom), which was then used to adjust the variance of the parameter estimates (McCullagh and Nelder, 1983).

The χ^2 -test was used to compare the involvement at various locations between male and female patients. Logistic regression models were fit to evaluate the association between patient characteristics and disease severity, defined as Hurley grade I vs. II or III. Associations were summarized using the estimated odds ratio OR and corresponding 95% CI. Each characteristic was evaluated in a model with and without adjusting for age at HS diagnosis. All calculated *P*-values were two-sided and *P*-values <0.05 were considered statistically significant.

CONFLICT OF INTEREST

The authors state no conflict of interest.

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